

## **Procedure for Modifying Lake Management Plan**

Any proposed changes will be made at an open meeting of the Peppermill Lake District Board, upon majority vote of the Lake District Board. The Lake Advisory Group will continue to hold meetings to review suggestions for changes and make recommendations to the board, consulting with the WDNR and Adams County Land and Water Conservation Department. Any interested person may make suggestions for changes to the Lake Advisory Group or to a member of the District Board.

## **BASELINE INFORMATION**

### **Lake Description**

Peppermill Lake is located in southeast Adams County, in the Town of Jackson, approximately 4 miles west of Oxford, Wisconsin. The impoundment has a surface area of 65 acres, with a maximum depth of 14 feet and a mean depth of 7 feet. The lake is the headwaters for Peppermill Creek, a tributary of Neenah Creek. Two miles of Peppermill Creek have been on the “impaired waterway” list for Wisconsin since 1998 due to heavy sedimentation, degraded habitat and increased water temperature. However, the creek continues to have a warm water fishery. Non-point pollution was identified as the main pollutant for the stream.

The water source for the lake is surface runoff and groundwater springs. The University of Wisconsin-Stevens Point Environmental Task Force Program evaluated the groundwater entering the lake in 2001. Groundwater generally flows northwest into the lake and flows northeastern out of the lake. The University of Wisconsin-Stevens Point Environmental Task Force Program also determined that stratification occurs in the deep holes during the winter and summer months, where mixing occurs in the spring and the fall. The Peppermill Dam, built in 1967, impounds water to form the lake. Adams County owns, operates, maintains and repairs the dam. A public boat launch located at the east end of Peppermill Lake, owned and operated by the Town of Jackson.

### **Climate**

The climate in the Peppermill Lake area is classified in the continental climate type. The summers have warm, but not excessively hot, days and cool nights. Historically, winters are long, cold, and snowy, although recent winters have varied greatly. Mean annual precipitation is almost 30 inches. The growing season generally extends from late May to early September, for an average frost-free growing season of 135 days. Prevailing winds come out of the northwest from late fall through spring and from the South during the remainder of the year. The wind speed generally ranges from 4 to 15 miles per hour. (Adams County Land and Water Resource Management Plan)

## Land Use

Both the surface and ground watersheds of Peppermill Lake are fairly small. The ground watershed extends north and west of the lake. Studies have shown that lakes are products of their watersheds. Land use in a watershed has a great impact on the water quality of its lake, especially in the amount and content of stormwater runoff from the surface. Runoff volume is affected by the amount of impervious surface, the soil type and the slope of the area. Natural landscapes tend to have low runoff amounts.

Land use acres and percent of total are shown on the chart below:

	Surface		Ground		Total	
Peppermill Lake	Acres	% of Total	Acres	% of Total	Acres	% of Total
Agriculture--Non Irrigated	97.51	9.31%	300.12	18.26%	397.63	14.77%
Agriculture--Irrigated	0	0.00%	214.39	13.04%	214.39	7.97%
Government	0	0.00%	45.2	2.75%	45.2	1.68%
Grassland/Pasture	0	0.00%	7.89	0.48%	7.89	0.29%
Residential	391.56	37.38%	233.21	14.19%	624.77	23.22%
Water	65.9	6.29%	0	0.00%	65.9	2.45%
Woodland	492.6	47.02%	842.77	51.28%	1335.37	49.62%
total	1047.57	100.00%	1643.58	100.00%	2691.15	100.00%

Woodlands are the largest land use category in the surface watershed and contribute less than 10% of phosphorus entering Peppermill Lake waters. Since forest floors are often full of leaves, needles and other duff, runoff from forested lands is may be more filtered than that from agricultural or residential lands.

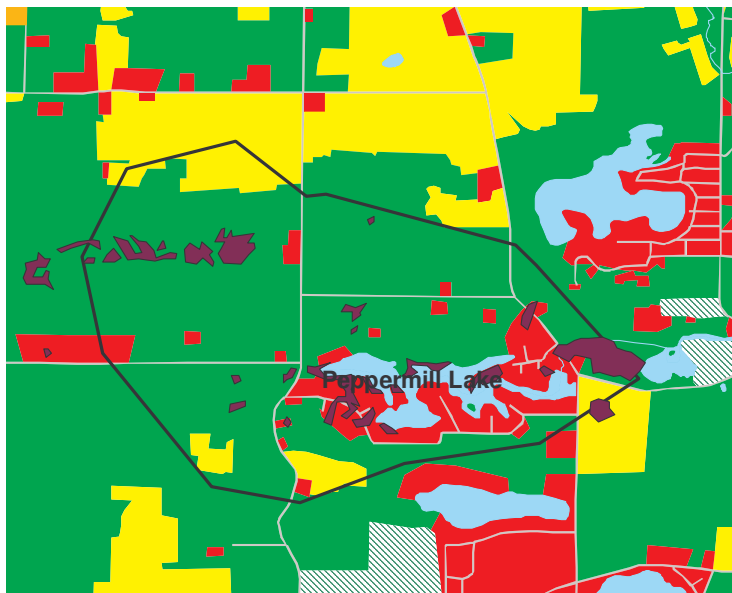
Residential land use is the second most common land use category in the Peppermill Lake surface watershed, especially around the lake itself, where residential land use is most concentrated. This land use category may contribute a significant amount of nutrients to the water from stormwater runoff, mowed lawns, and impervious surfaces.

Only 9.3% of the Peppermill Lake surface watershed is in agricultural use. Traditionally, agriculture may contribute significantly to the amount of nutrients in water.

The ground watershed land use is mainly of agricultural, woodland and residential use. There are also wetlands in the Peppermill Lake watersheds. Most of the wetlands in the ground watershed are scattered, but those in the surface watershed are concentrated near the lake.

The maps on the next page show the most recent land-use information:

## Land Use--Peppermill Lake Surface Watershed



Surface Watershed  
Boundary

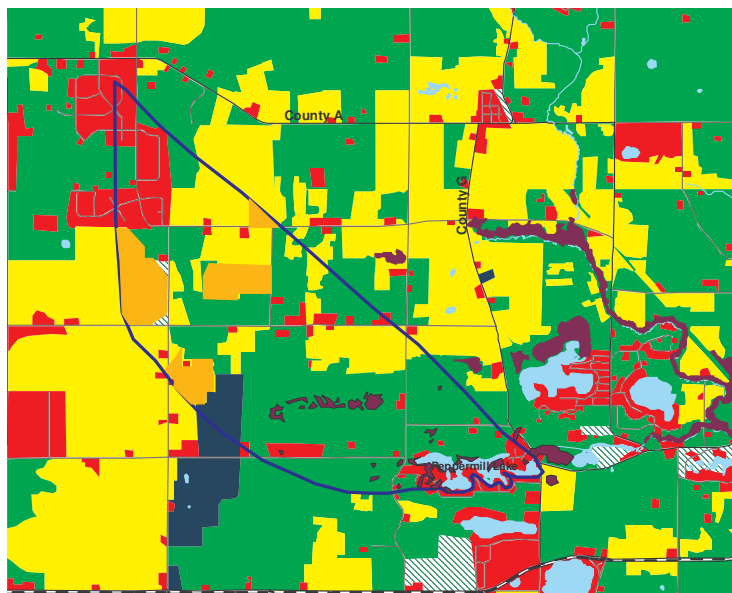
### Land Use

- AGRICULTURE
- GRASSLAND/PASTURE
- RESIDENTIAL
- WATER
- WETLANDS
- WOODLANDS



RE:2/05

## Peppermill Lake--Ground Watershed Land Use



Peppermill Lake Ground Watershed

### Land Use (2004)

- NON-IRRIGATED AGRICULTURE
- IRRIGATED AGRICULTURE
- GOVERNMENTAL
- GRASSLAND/PASTURE
- RESIDENTIAL
- WATER
- WETLANDS
- WOODLANDS



RE:2/05

## **Public Use and Values**

The Peppermill Lake Association/District conducted landowner surveys in 2001 and 2004 to determine lake use, perceptions, and practices that may affect the lake water quality. Fishing, boating, peace/solitude were the top recreational activities for lake users in 2001, while in 2004, fishing, boating, peace/solitude, and scenic enjoyment were the top recreational activities. The 2001 survey attempted to gather information on septic systems, but response was incomplete. The 2004 survey results stated on average, survey respondents' septic systems were inspected every 1-2 years. The 2004 survey results stated 70% of the respondents felt the lake level has not changed significantly, and 65% said there should be no adjustments to the lake level. Other results of the surveys:

	<u>2001</u>	<u>2004</u>
Surveys returned	74%	59%
Average ownership of property	11.6 years	13.6 years
Year around residents	17.7%	20%
Seasonal residents	82.3%	80%
Properties with mowed lawns	72.5%	63%
Properties that use fertilizers	14.8%	10%
Septic systems inspections	Not available	1-2 years

The 2001 and 2004, surveys of the Peppermill Lake Community found weeds were perceived as the major water quality problem, followed by algae and water clarity. The 2004 survey results showed those who see water quality declining felt it is due to weeds (56%), development (23%), septic systems (20%), and herbicides (16%). Other results:

	<u>2001</u>	<u>2004</u>
Residents who think water quality has declined	50.9%	26%
Perception of water quality		
Good to excellent	83%	92%
Fair	15%	6%
Poor	2%	2%

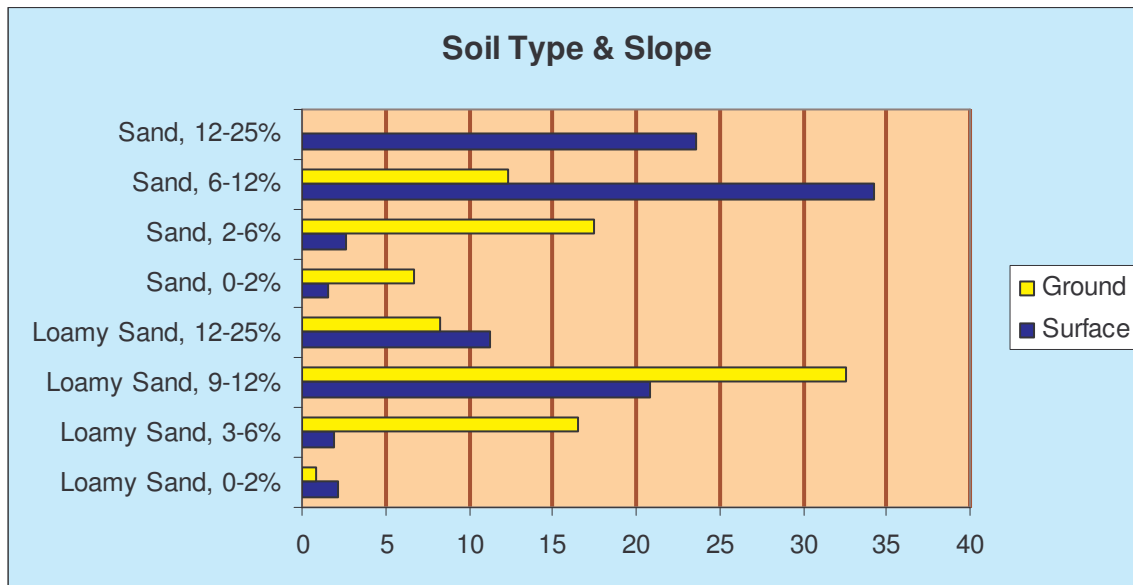
The Peppermill Lake District intends to repeat the survey in 2008, as well as survey general lake users for their input on lake status.

The 2004 survey of the Peppermill Lake Community showed 100% of the respondents support the no-wake ordinance currently in effect. The survey also indicated that over 40% of the respondents enjoyed the quiet peacefulness of the lake, with many complaining about noises from lakeshore activities.

## **Soils**

The bulk of the soils in both the surface and ground watersheds for Peppermill Lake are sandy. In the surface watershed, Sand dominates, comprising 62.1% of the soil. Loamy Sand is second with 58.2% coverage. The situation is reversed in the ground watershed, with 58.2% of the soil there being Loamy Sand and only 36.5% of it being Sand. In both watersheds, there

are small pockets of gravel, muck and silt loam. Slopes range from flat to slopes in the 12% to 25% class.



Sands and Loamy Sands are generally well-drained to somewhat excessively drained, with moderate to rapid permeability in the surface layer and slow to rapid permeability in the subsurface layers. Land runoff is slow to rapid, mostly depending on slope. Available water capacity ranges from usually low, as is natural fertility organic matter content. There are wide ranges of suitability for cropping, tree-production and engineering uses. Most of these soils have erosion, blowing and drought hazards as well. Depth to groundwater is mostly over 20', although there are some areas of perched water tables. Bedrock is mostly sandstone.

### **Lake Shape**

Peppermill Lake is longer east-west than it is wide north-south. The lake has several lobes, with each having a “deep spot”. The west end is somewhat deeper than the east end and is fed by several springs. The water at that end is somewhat cooler than that of the shallower east end, and the aquatic plants in the west part of the lake mature later than those in the east end. Recently, it appears that for aquatic plant management, the lake may need to be divided into west and east to make management more appropriate.

### **Shorelands**

Peppermill Lake has a total shoreline of 4.4 miles (23,232 feet). Much of the northern shore of the western lobe of the lake has been left unaltered and contains some wetland areas. The rest of the lakeshore is in residential use. Residential concentration tends to vary in density, depending on the lobe of the lake and shore direction. Small parts of the shore are steeply sloped, but much of it is only gently sloped. Most of Peppermill Lake’s shoreline is vegetated.

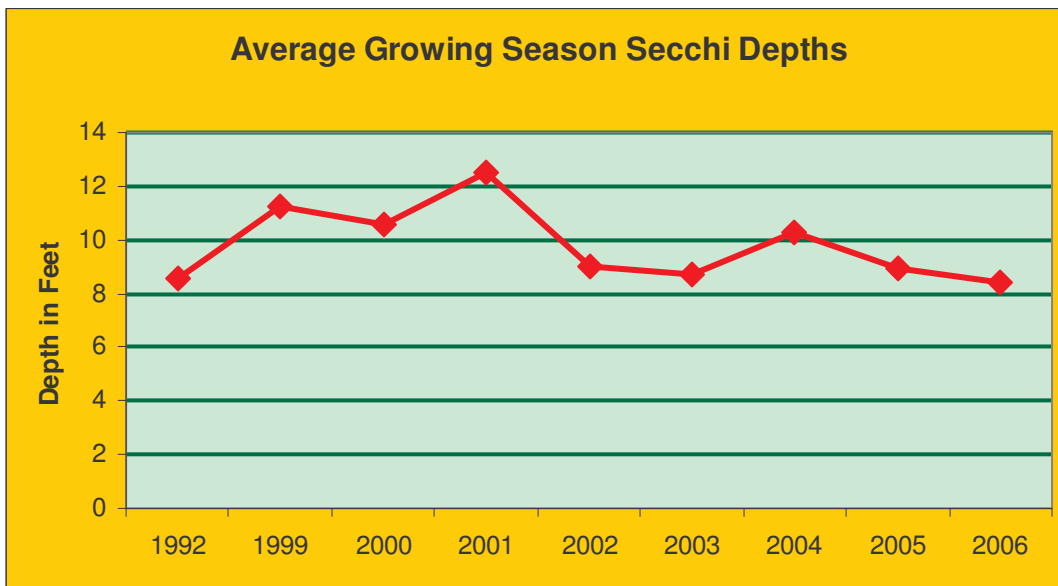
A 2004 shore survey showed that much of the shore had an “adequate buffer. As “adequate buffer” is a native vegetation strip at least 35 feet landward from the shore. Still, some 24%

had inadequate buffers. Most of the “inadequate” buffer areas were those with mowed lawns and insufficient native vegetation at the shoreline to cover 35 feet landward from the water line. Several additional buffers were installed in 2007 to start addressing some of the “inadequate buffer” areas.

### **Lake Chemistry**

A significant amount of information is available on the chemistry of Peppermill Lake’s waters. The Adams County Land & Water Conservation Department took several samples year around between 2004 and 2006. UWSP staff and students, with the assistance of a grant from the WDNR, studied several aspects of the lake in 2000-2001. The relatively shallow nature of Peppermill Lake and its impoundment status make this regionally popular water resource sensitive to nutrient inputs (Assessment of Lake and Groundwater Chemistry, Shallow Groundwater Flow, and the Aquatic Macrophyte Community, Peppermill Lake, 2002). Wisconsin Department of Natural Resources (WDNR) Self-Help data has been collected and analyzed according to DNR criteria. The watershed to lake ratio is 9.5:1. Negative water quality impacts from the watershed are generally seen when the drainage area/lake size ratios exceeded 10:1. For many years, one lake resident—Richard Magnani—has taken samples and readings as part of the WDNR Self-Help Monitoring Program (now called Citizen Lake Monitoring Program).

Secchi disk averages have generally been in the “good” or “very good” category, as shown on the chart below:

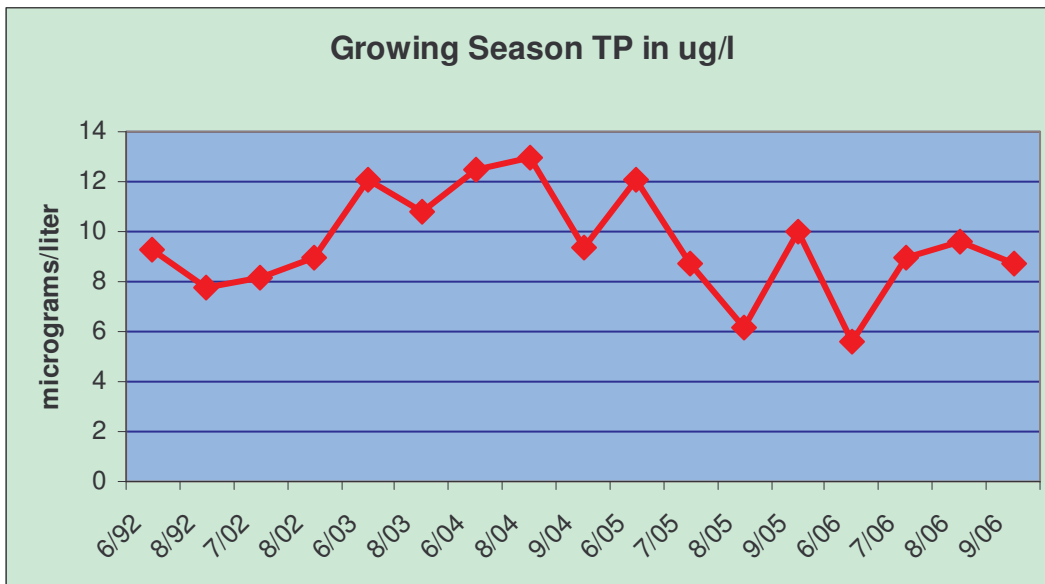


Like many lakes in Wisconsin, Peppermill Lake is a phosphorus-limited lake. This means that of the pollutants that end up in the lake, the one in the shortest supply and most affects the overall quality of the lake water is phosphorus. Land use types play a major role in determining the amount of phosphorus being loaded into the lake. Human activities can affect the amount of phosphorus in a lake, as can weather and climate.

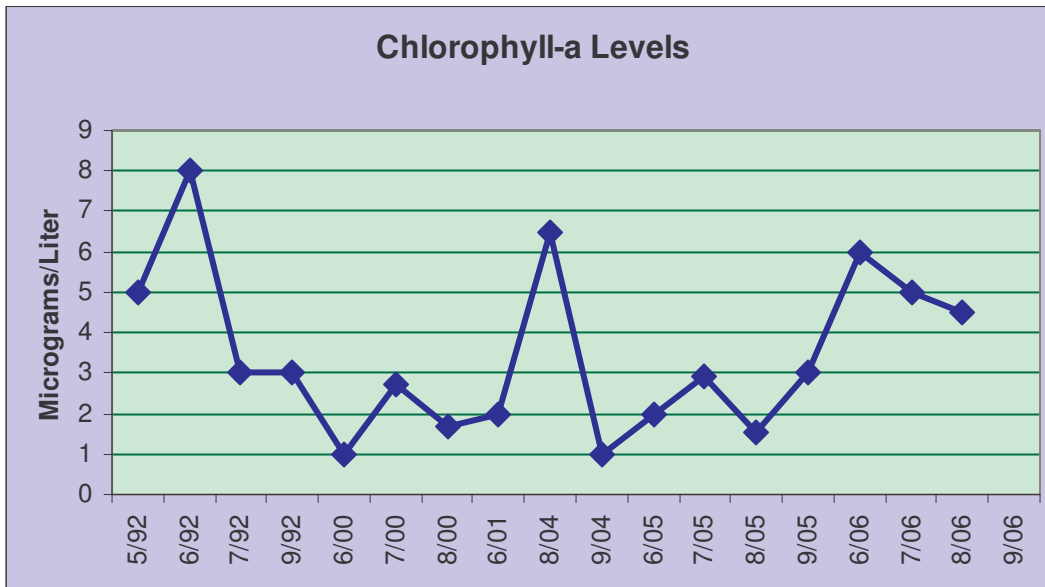
Growing season average total phosphorus readings in Peppermill Lake have varied substantially from 1992 through 2006, from a low of 5.6 micrograms/liter to a high of 12.98 micrograms/liter. The variations are shown on the chart on the next page. Overall, compared to many impoundments in Wisconsin, the growing season total phosphorus levels for Peppermill Lake are fairly low.

The waters of Peppermill Lake are well-buffered against any acid rain or heavy metal input. The average pH level for 2004-2006 at 13' depth was 6.58 (close to the neutral 7); at 10' depth, it was 6.69; at 5' depth, the average pH was 7.08; and at the surface, the average pH was 7.4

The Adams County LWCD also took readings for sulfate, potassium, magnesium, copper, sodium. All of these readings are low, with none reaching any level of concern. Calcium was also looked at, especially since it is needed for native snail and mollusk shell growth. The average calcium level for 2004-2006 was 40.09 milligrams/liter. The UWSP study also looked at chloride levels to see if there was any indication that leaking septic systems might be an issue, but they found no such levels.



From 2004 to 2006, regular readings were taken during the growing season for chlorophyll-a levels. Chlorophyll-a is a pigment used by plants and algae for photosynthesis. Studies have found that the pigment level correlates to the algal level of a lake. Some chlorophyll-a testing was also done as part of the Self-Help Monitoring Program. Generally, chlorophyll-a levels of Peppermill Lake water were low, considerably under the level recommended to avoid frequent algal blooms. Algal blooms on Peppermill Lake tend to be localized and also directly connected to periods of very hot weather. Average levels of chlorophyll-a for the years available are shown on the below chart:



The lake has been running an aerator in the winter to avoid fish kills from low oxygen, which have sometimes occurred in the past. However, it should be noted that the deep hole of Peppermill Lake sometimes becomes hypoxic in the summer at the bottom of the water column: in August of 2003, the dissolved oxygen level was 4.8 milligrams/liter. In August of 2004, it was 3.6 mg/l near the end of the month and down to 3.3 mg/l by mid-September. A similar pattern was followed in 2005, when dissolved oxygen levels in late June were 4.9 mg/l, then dropped as low as 1.7 mg/l by mid-August. There were no low dissolved oxygen levels in 2006. The upper levels of the water did remain over 5 mg/l, so there were refuges for the fish from the low oxygen levels.

One of the measures Wisconsin uses to give a general estimate of a lake's water quality is the **trophic state index**. This index looks at a lake's water clarity, its amount of total phosphorus (the element most related to aquatic plant and algal growth), and its chlorophyll-a level (chlorophyll-a is a pigment used by algae for photosynthesis).

Depending on the trophic index score, lakes are then classified as **Oligotrophic** (good), **Mesotrophic** (fair), or **Eutrophic** (poor):

- **Good:** Oligotrophic lakes have clear, deep water with few algal blooms. Larger game fish are often found in such lakes.
- **Fair:** Mesotrophic lakes have more aquatic plant and algae production, with occasional algal blooms and a good fishery. The water is usually not as clear as that of oligotrophic lakes.
- **Poor:** Eutrophic lakes are very productive, with lots of aquatic plants and algae. Algal blooms are often frequent in these lakes. They may have a diverse fishery, but rough fish (such as carp) are also common. Water is often cloudy or murky. Small shallow lakes are more likely to be eutrophic.

<i>Score</i>	<u><b>TSI Level Description</b></u>
<b>30-40</b>	<b><u>Oligotrophic:</u></b> clear, deep water; possible oxygen depletion in lower depths; few aquatic plants or algal blooms; low in nutrients; large game fish usual fishery
<b>40-50</b>	<b><u>Mesotrophic:</u></b> moderately clear water; mixed fishery, esp. panfish; moderate aquatic plant growth and occasional algal blooms; may have low oxygen levels near bottom in summer
<b>50-60</b>	<b><u>Mildly Eutrophic:</u></b> decreased water clarity; anoxic near bottom; may have heavy algal bloom and plant growth; high in nutrients; shallow eutrophic lakes may have winterkill of fish; rough fish common
<b>60-70</b>	<b><u>Eutrophic:</u></b> dominated by blue-green algae; algae scums common; prolific aquatic plant growth; high nutrient levels; rough fish common; susceptible to oxygen depletion and winter fishkill
<b>70-80</b>	<b><u>Hypereutrophic:</u></b> heavy algal blooms through most of summer; dense aquatic plant growth; poor water clarity; high nutrient levels

**Peppermill Lake's overall TSI is 46**

According to the most recent computer modeling, using lake chemistry results from 2004 through 2006, phosphorus loading is coming from four main areas: non-irrigated agriculture; residential; woodlands; and ground watershed. The lake management plan hopes to address the phosphorus loading issues in the areas that can be controlled by humans, including stormwater runoff, buffers, aquatic plant harvesting, septic system inspection and similar activities. For example, the UWSP reports indicated that according to the WDNR, if the machine harvesting aquatic plants removes between 41 and 92 tons of plants per year, 135 kg/yr of phosphorus would be removed from the lake.

### **Aquatic Plant Community**

In 1998, Eurasian watermilfoil was identified as a potential large-scale problem, but the native plant community was effectively competing with the Eurasian watermilfoil. Chemical control was begun on 1999 and continued through 2007 (information for 2007 not yet available).

<b>Year</b>	<b>Navigate (lbs)</b>	<b>DMA-4 IVM (gal)</b>
1999	300	
2000	700	
2001	1550	
2002	1400	
2003	352.23	5
2004	270	110
2005	300	
total	4872.23	115

Mechanical harvesting of aquatic plant started in 2003 and continued through 2007. The Lake District does not own a harvester, so hires a local contractor to perform the machine harvesting.

No plant testing was done for 2006 or 2007, so estimates of pounds of phosphorus removed are not available at this time. Testing will resume in 2008.

Year	Lbs Removed
2003	135,000
2004	114,000
2005	45,000
total	294,000

In 2001, the University of Wisconsin-Stevens Point Environmental Task Force Program completed a plant survey that found the aquatic plant community is above average quality according to the Aquatic Macrophyte Community Index. In 2006, a new aquatic plant survey was conducted by staff of the WDNR and Adams County LWCD. Because the methods used varied, a complete comparison of the 2001 and 2006 survey results couldn't be made, but there was some information that could be compared.

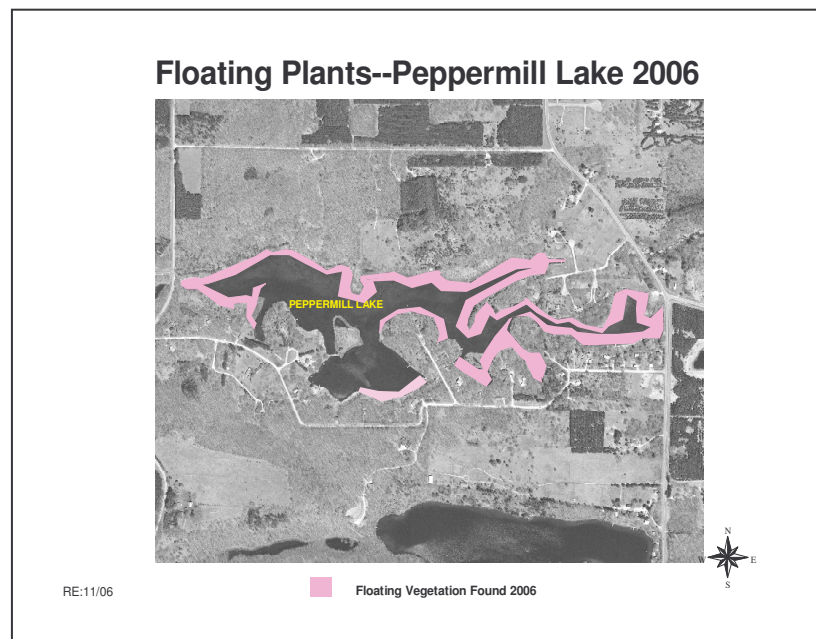
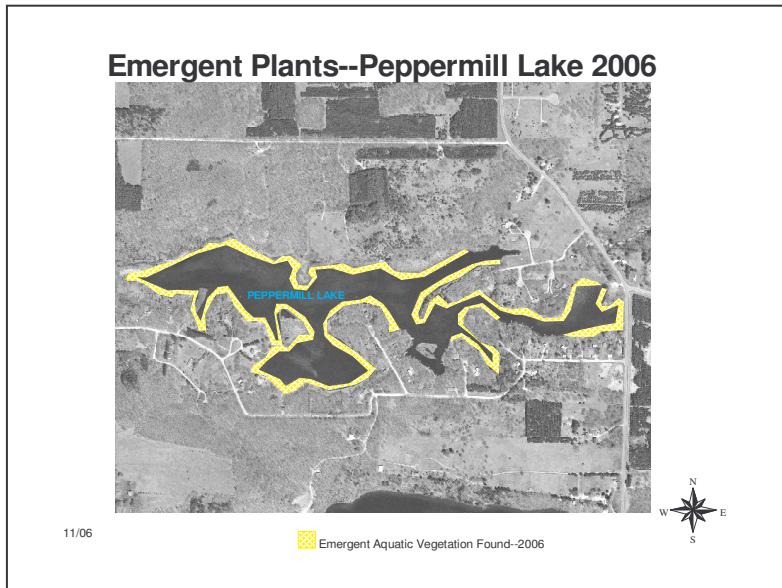
	2001	2006
Number of Species Found	17	32
Average Coefficient of Conservatism	4.76	5
Floristic Quality Index	19.85	28.28
Simpson's Index of Diversity	91	93
Aquatic Macrophyte Community Index	43	54

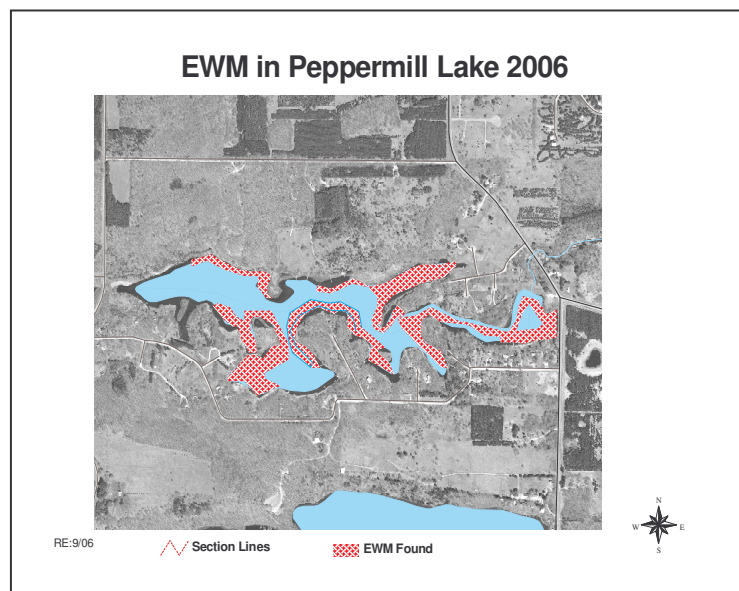
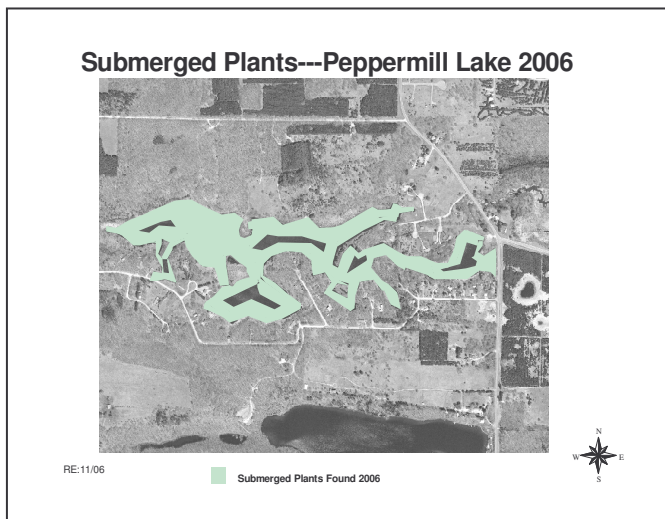
Overall, the results of the 2006 aquatic plant survey showed a higher quality and more diverse aquatic plant community than the survey done in 2001. Both surveys indicated that over 90% of the lake sediment is soft, with high natural fertility—marl, muck, peat, silt or mixtures thereof. Such sediments have the capacity to support high aquatic plant growth. In both instances, the macrophytic-algae *Chara* spp. was the most frequently occurring aquatic species. In the 2006 survey, *Chara* spp. was the only species that occurred in higher than average density throughout the lake. Two species—*Najas flexilis* (Bushy pondweed) and *Nymphaea odorata* (white water lily)—occurred at more than average density where they were present. The highest frequency and density of aquatic species was in the 0-1.5' depth zone.

The 2006 survey found 100% of the sites examined were vegetated, with 25.26% of the shoreline covered with disturbed areas (lawn, rock riprap, hard structure, erosion). At the disturbed shores, there were fewer aquatic species, more filamentous algae, lower Simpson's Index of Diversity, and lower Floristic Quality Index. The 2006 survey identified 36 aquatic species, 2 of which were exotic invasives: *Myriophyllum spicatum* (Eurasian watermilfoil) and *Potamogeton crispus* (Curly-leaf pondweed). One big change since the 2001 survey was that many more emergent plants were found during the 2006 survey—in 2001, only 2 emergents were found; in 2006, 15 emergents were found. Emergents provide important fish habitat and spawning areas, as well as food and cover for wildlife. The 2006 survey revealed a more varied structure in the aquatic plant community: besides the 15 emergents, there were 2 free-floating species, 3 rooted floating-leaf species and 15 submergent species. Free-floating species provide cover for fish and invertebrates and are eaten by fish and waterfowl. Floating-

leaf vegetation provides cover and dampens waves, protecting the shore. A diverse submergent community provides many benefits.

The 2004 Peppermill Lake Survey stated 95% of the respondents supported general weed harvesting. 66% of the respondents wanted more plants to be harvested, 30% wanted the same amount as current, and 16% wanted fewer plants to be harvested. The maps below show the distribution of plant types found in 2006.





## **Critical Habitat**

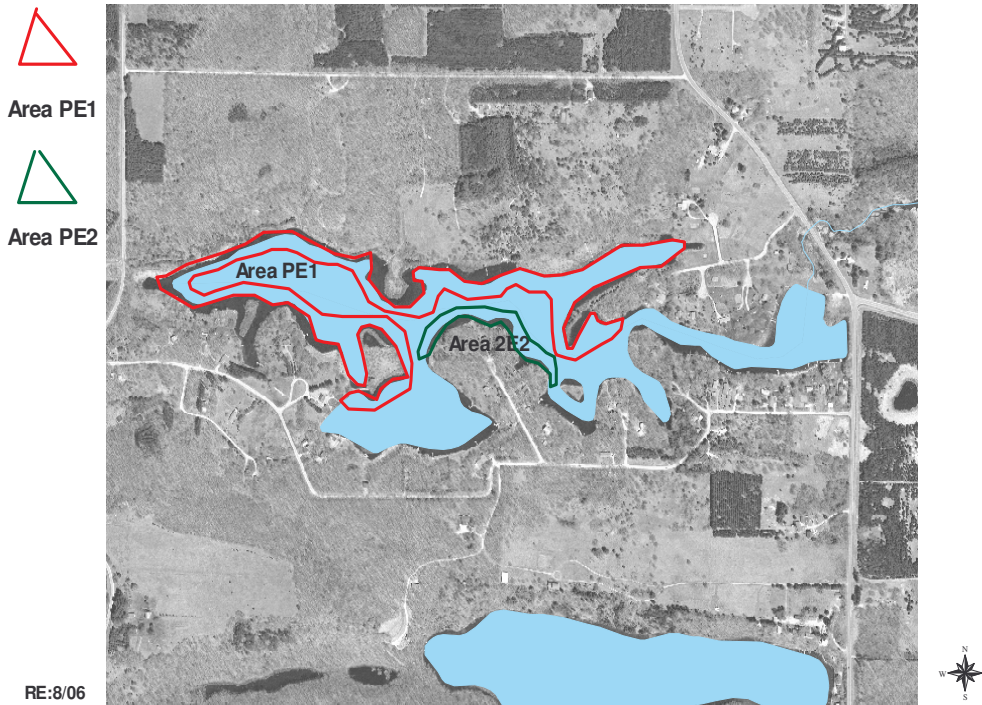
Wisconsin Rule 107.05(3)(i)(I) defines a “sensitive areas” as: “areas of aquatic vegetation identified by the department as offering critical or unique fish & wildlife habitat or offering water quality or erosion control benefits to the body of water. Thus, these sites are essential to support the wildlife and fish communities. They also provide mechanisms for protecting water quality within the lake, often containing high-quality plant beds. Finally, sensitive areas often can provide the peace, serenity and beauty that draw many people to lakes in the first place.

Protection of critical habitat areas must include protecting the shore area plant community, often by buffers of native vegetation that absorb or filter nutrient & stormwater runoff, prevent shore erosion, maintain water temperature and provide important native habitat. Buffers can serve not only as habitats themselves, but may also provide corridors for species moving along the shore. Besides protecting the landward shore areas, preserving the littoral (shallow) zone and its plant communities not only provides essential habitat for fish, wildlife, and the invertebrates that feed on them, but also provides further erosion protection and water quality protection.

Two areas on Peppermill Lake were determined to be appropriate for critical habitat designation. PE1 extends along approximately 7000 feet of the northwest 2/3 shoreline of the lake, up to the ordinary high water mark. Sediment includes marl, muck, peat, silt and mixtures thereof. 12% of the shore is wooded; 61% has shrubs; 27% is native herbaceous cover. Shrub-carr is found along part of the shore. Large woody cover is common for habitat. With minimal human disturbance along this shoreline, the area has natural scenic beauty. Maximum rooting depth of aquatic vegetation in PE1 was 7.5 feet. Several types of emergent aquatic plants were found in this area: *Acorus* (Sweet Flag); *Asclepias* (Swamp Milkweed); *Carex* spp (Sedge); *Cicuta* (Water Hemlock); *Leersia* (Rice Cutgrass); *Onoclea* (Sensitive Fern); *Rumex* (Water Dock); and *Scutellaria* (Scullcap). Free-floating plants included *Lemna minor* (Small Duckweed) and *Spirodela polyrhiza* (Great Duckweed). A variety of submergent aquatic plant characterized this area. Because this site provides all three structural types of vegetation, the community has a diversity of structure and species that supports even more diversity of fish and wildlife.

PE2 extends along approximately 800 feet in the middle of the southern shore. Sediment includes gravel, marl, muck, peat, and mixtures thereof. 35% of the shore is wooded; 10% is native herbaceous cover; the remaining shore is cultivated lawn and a little hard structure. Shallow marsh covers part of the shore. Large woody cover is common for habitat. Maximum rooting depth in PE2 was 8 feet. No threatened or endangered species were found in this area. One exotic invasive, *Myriophyllum spicatum* (Eurasian watermilfoil), was found in this area. Filamentous algae were present, especially near the shores. Only two types of emergents were found here: *Carex* and *Sparganium*. Two floating-leaf rooted plants were present: *Nuphar variegata* and *Nymphaea odorata*. Two free-floating plants, *Lemna minor* and *Spirodela polyrhiza*, were also at this site. The remaining aquatic plants were submergents; *Chara* spp., *Myriophyllum sibiricum*, *Myriophyllum spicatum*, *Najas flexilis*, and *Potamogeton friesii*.

## Critical Habitat Areas--Peppermill Lake



### Lake Fishery

In the summer of 2001, a survey of the Peppermill Lake Community found 72 % of the respondents rated the fishing average or better, while 23.2% rated it fair and 4.6% as poor. The survey showed approximately 55% of the respondents felt the quality of fishing had stayed the same or improved while 45% felt it had declined. A concern about small fish size was expressed by several.

In 2004, a survey of the Peppermill Lake Community found 66 % of the respondents rated the fishing average or better, while 20% rated it fair and 4% rated the fishing as poor. The survey showed approximately 56% of the respondents felt the quality of fishing had stayed the same, 45% felt it had declined and no one felt it had improved. Results of the survey showed those who felt the fishery was in decline felt it was due to over-fishing, weeds, and soil erosion.

WDNR conducted a fish survey in 1999 and compared the results with historic records of fish populations. It was determined that Northern pike and Largemouth bass populations have fluctuated over time due to natural causes, winterkills, stocking and more restrictive size and bag limits. The 1999 survey found that Northern pike and Largemouth bass numbers were high; Northern pike size structure was good with a mean length of 20.6 inches; Largemouth bass size structure was slightly down with a mean length of 10.6 inches; Bluegill numbers had increased, with their size structure decreasing to a mean length of 3.9 inches. WDNR concluded predatory control of bluegill was not occurring in Peppermill Lake due to the high density of aquatic vegetation in the lake. WDNR recommended mechanical harvesting of

aquatic plants to create areas of open water to improve fish predation, navigation and fishing opportunities.

In 2001, the University of Wisconsin-Stevens Point, Wisconsin Cooperative Fishery Research Unit evaluated the status of the fish community. Results of the survey found high numbers of small bluegill and low numbers of largemouth bass and northern pike. It was determined that high aquatic plant growth might be hindering predation and bluegill growth. Recommendations for improving numbers of black crappie, yellow perch, northern pike, and largemouth bass were: conducting a growth study of the bluegill population to determine if stunting or angler harvest is responsible for the current size structure of the population; mechanical harvesting of aquatic vegetation in channels to create edge-effect; continued stocking of northern pike and largemouth bass; and fishing regulation changes.

The WDNR conducted a boom shock survey of Peppermill Lake during October 2006. Those results showed a good largemouth bass population, with an average length of 13.4". The bluegill presence was abundant, and the average length was up to 4.3". Northern pike were also common, with an average length of 18.3". Black crappie, pumpkinseed and yellow perch continued to be scarce, although they were present during the 2006 survey. Average length was: 11.2" for black crappie; 6.8" for pumpkinseed; and 5.7" for yellow perch.

Between 1995-2004, volunteer lake owner groups installed several fish habitat improvement projects: deposit of pea gravel at nine near-shore sites to improve bass spawning; construction and placement of fish cribs in 3' to 5' of water at nine sites to provide cover; trees dropped into water at ten strategic points on the shoreline to provide fish habitat; and periodic fish stocking.

In the 1970's and early 1980's, there were four severe winterkills of fish due to low dissolved oxygen levels from the decomposition of vegetation and organic material (Ironside, WDNR Fisheries Biologist, 1999). Two aeration systems were installed in 1992 to improve the low oxygen conditions.

### **Endangered/Threatened Resources**

Endangered resources reported in the Peppermill Lake watersheds include *Anemone nemorosa* (Early Anemone) and *Plantanthera hookeri* (Hooker's orchid).



**Hooker's  
Orchid**

**Early  
Anemone**



## **Peppermill Lake District**

The Peppermill Lake District was formed in 2002, combining two former lake associations. The district board consists of three lake area residents, one Town of Jackson representative, and one Adams County representative. The district is responsible for the management of the lake.

## **Regulations**

Adams County has a Comprehensive Zoning Ordinance that regulates land use, a Shoreland Protection Ordinance that regulates activities in areas within 300 feet of a stream and 1,000 feet of a lake, a Sanitary Ordinance that regulates on-site sanitary systems, a Floodplain Ordinance that regulates activities within the flood plains, a Land Division Ordinance that regulates division of properties, and a Building/Construction Ordinance that regulates building and construction activities. The Town of Jackson utilizes the Adams County Planning and Zoning and their ordinances to regulate activities. A revised Shoreland Ordinance and a Stormwater Management Ordinance are currently being reviewed.

## **Priority Watershed**

From 1992-2002, many conservation practices were planned in the Upper Neenah Creek (which includes Peppermill Lake) watershed as part of the state's Priority Watershed Program for Neenah Creek. That plan indicated that the watershed had 4 inventoried animal lots that contributed 133 pounds of phosphorus annually to the entire watershed. According to this plan, upland sediment delivery to the lake was estimated at 10 tons per year, less than 1% of the entire upland sediment load. The major sediment source for this watershed—about 60% of the watershed sediment load—was identified as lakeshore erosion. The sediment load from streambanks and lakeshores in the Upper Neenah Creek Watershed was reported to be 487 tons.

The plan made only two recommendations for this subwatershed: (1) minimization of the effects of agriculture & other nonpoint pollution sources; (2) maintain trout habitat.

## **GOALS AND ACTIONS FOR MANAGEMENT PLAN**

The goals and actions items of the Peppermill Lake Management Plan have been divided into eight areas: Aquatic Plant Management (including Exotics); Protection of Critical Habitat Areas; Dam Operation and Management; Recreational Management (fisheries, wildlife, etc.); Management of Shoreland Areas; Water Quality; Water Quantity; and Watershed Outside Shoreland Areas.

## **AQUATIC SPECIES MANAGEMENT**

<b>Machine harvest aquatic plants to improve water quality, to provide safe boating areas, control invasive species, and to improve aquatic habitat.</b>	WHO	WHEN
<u>A. Machine Harvesting Protocol</u>		
1. No machine harvesting in areas between shorelines and ends of boat docks.	Peppermill Lake District	ongoing
2. No machine harvesting in water less than 3' deep at any time.	Private Contractor	
3. Target machine harvesting for Eurasian Watermilfoil will be done in May and September. During this harvesting, cutting should be done as far down as possible, although no more than 1' from the bottom.		
4. Machine harvesting in June, July and August will be done to provide navigational channels 30' wide and fish edge habitat.		
5. Machine harvesting should occur at a slow pace to decrease the likelihood of additional sediment disturbance.		
6. At the end of each harvest cycle, the harvester should make a last pass to pick up as many fragments as possible.		
B. Pursue funding for harvester purchase	Peppermill Lake District	2008
	Adams LWCD, WDNR	
<b>Monitor the harvesting of aquatic plants</b>		
A. WDNR representative and/of staff of Adams County LWCD and a Peppermill Lake District representative will annually inspect the machine harvesting operations.	Peppermill Lake District	ongoing
	Adams LWCD, WDNR	
B. The pounds of aquatic plants removed by machine harvesting will be recorded annually by taking an average weight of a trailer full of harvested plants and multiplying that weight by the number trailer loads. The annual weight shall be documented and reported to the WDNR Aquatic Plant Specialist by 12/31 each year.	Peppermill Lake District	annually
C. Annual wet tissues samples will be randomly taken from harvested plants and sent to a certified lab to measure the phosphorus content. This is done to determine the amount of phosphorus being removed from the lakes by harvesting plants. The testing results	Peppermill Lake District	annually

should be documented and reported to the WDNR Aquatic Plant Specialist by 12/31 each year.		
<b>Educate and encourage shoreline owners to hand-harvest.</b>	WHO	WHEN
A. Educate individual shorefront owners about hand-harvesting a 30- wide access corridor in front of their property using information from the WDNR and/or other lakes and possibly developing a "how to and when" informational sheet.	Peppermill Lake District Adams LWCD, WDNR	ongoing
B. Encourage shorefront owners to remove fragments floating ashore from boat traffic and/or harvesting.	Peppermill Lake District Adams LWCD, WDNR	ongoing

## **INVASIVE SPECIES MANAGEMENT**

<b>Seek funding for control/management of invasive species.</b>	WHO	WHEN
A. Apply for WDNR or other grants to assist in costs of managing/control of invasive species.	Peppermill Lake District	ongoing
<b>Control invasive species utilizing chemical treatments</b>		
A. Spot-treat invasive species with chemicals specific for each species.	Peppermill Lake District private contractor	ongoing
B. Use pre & post treatment monitoring for chemical treatments, including (1) dividing the lake into east and west zones for chemical treatments; (2) setting up temperature stations along the lake, including in lake lobes, to fine-tune chemical treatment by temperature monitoring; (3) use ACLWCD for independent verification for pre- and post-treatment locations;(4) have ACLWCD work directly with applicator for better coordination.	Peppermill Lake District private contractor Adams County LWCD	ongoing
<b>Control Eurasian watermilfoil by cultural and biological methods</b>		
A. At this time, drawdowns are not an appropriate method for EWM control, due to the shallow nature of the lake and possible interference with fish survival.	Peppermill Lake District	ongoing
B. Now that native weevil presence has been determined, invite expert to educate board and citizens on how to increase their presence and make them part of EWM control.	Peppermill Lake District Adams LWCD, WDNR other agencies	2008

C. If increasing weevil population is determined to be scientifically and financially feasible, develop plan and apply for funding to increase weevil presence.	Peppermill Lake District Adams LWCD, WDNR	2009
D. Encourage landowners to hand-harvest EWM and other invasive species wherever they are found.	Peppermill Lake District Adams LWCD, WDNR	ongoing
<b>Control invasive species utilizing monitoring and identification and other methods.</b>		
A. Develop separate map for invasive species monitoring.	Peppermill Lake District Adams LWCD	annually
B. Recruit and train more monitors for invasive species monitoring on the lake.	Peppermill Lake District Adams LWCD	2008-2009
C. Recruit and train more volunteers for Clean Boats, Clean Waters Program.	Peppermill Lake District Adams LWCD	2008-2009
D. Establish regular schedule for visual monitoring and Clean Boats, Clean Waters volunteers.	Peppermill Lake District Adams LWCD	2008-2009
E. Conduct formal aquatic plant survey every 3 to 5 years, to add to information from 2001 and 2006 surveys.	Adams LWCD	2009
D. Maintain educational and exotic species identification signs at landing.	Peppermill Lake District WDNR	ongoing
E. Install simple boat washing station at boat landing. Apply for grant to fund installation.	Peppermill Lake District	2008

## **PRESERVATION OF CRITICAL HABITAT AREAS**

<b>Protect sensitive areas from mechanical and chemical disturbances</b>	<b>WHO</b>	<b>WHEN</b>
A. Distribute map of areas on lake determined to be critical habitat areas.	Adams LWCD Peppermill Lake District	2008
B. Present educational session on purpose of critical habitat determinations and how such determinations affect lake management.	Adams LWCD Peppermill Lake District	2008

## **DAM MANAGEMENT**

<b>Maintain and operate Peppermill Dam to: insure public safety, proper dam function and a stable lake level.</b>	<b>WHO</b>	<b>WHEN</b>
A. Conduct annual inspections and record findings as specified in WDNR standards.	engineer certified by Nat'l Assoc. of Prof. Eng. Adams LWCD	annually
B. Operate, inspect and repair dam to meet Wisconsin laws in Chapter 31 and NR Chapter 330.	Adams LWCD and/or dam lessee	weekly
C. Develop an Emergency Action Plan	Adams LWCD	2008
D. Investigate feasibility of generating sufficient electricity at dam to operate lake aerators.	Adams LWCD	2008

## **RECREATIONAL MANAGEMENT**

<b>Improve bluegill, black crappie, yellow perch, northern pike, and largemouth bass fisheries.</b>	<b>WHO</b>	<b>WHEN</b>
A. Stock fish as funding allows based on recommendations from fisheries biologists. Based on boom shocking survey in 2006, current recommendation is that neither largemouth bass nor panfish need to be stocked in Peppermill Lake. Fingerlings of northern pike may be stocked if available.	Peppermill Lake District WDNR	ongoing
B. Make recommendations to WDNR and County Lake Alliance to establish new regulation for county lakes to increase bass size limit to 16 inches. This recommendation is based on the 2001 2001 fish survey.	Peppermill Lake District WDNR	2008
C. Place 8 trees in lake littoral zone each year to increase fish habitat.	Peppermill Lake District	2007 - 2010
D. Set up protocol for using aerator during winter instead of running it constantly: (1) use purchased dissolved oxygen meter to monitor dissolved oxygen levels at least every two weeks in the deep hole(s) of the lake after snow cover on safe ice (>5 inches) from top to bottom at about 3' intervals; (2) turn on aerator when average dissolved oxygen in top half of lake is 6 milligrams/liter or less; (3) conduct annual maintenance inspection of aeration system to insure it can be operated when needed.	Peppermill Lake District	ongoing
<b>Maintain recreational opportunities while maintaining peace and solitude.</b>		
A. Continue to implement slow no-wake ordinance by turning violators	Peppermill Lake	ongoing

in to WDNR.	residents	
B. Maintain slow no-wake ordinance signs at major peninsulas of lake.	Peppermill Lake District	2006
C. Explore ordinance that other lake districts/assoc. have for noise control.	Peppermill Lake District	ongoing
D. Explore ordinances that other lake districts/assoc. have for light trespass.	Peppermill Lake District	ongoing
E. Explore north shore conservancy.	Peppermill Lake District	2007-2008
<b>Incorporate the goals of the general public into the mgmnt plan.</b>		
A. Conduct public users survey to identify important management issues. Surveys and dropboxes will be located at boat launches for one year.	Peppermill Lake District	2008
B. Conduct lake community survey to compare to 2004 results.	Peppermill Lake District	2008
<b>Increase wildlife populations</b>		
A. Survey lake residents as to the type of wildlife they want to see increase and develop a plan that describes methods of implementation.	Peppermill Lake Dist.	2008

## **SHORELANDS MANAGEMENT**

<b>Reduce nutrients entering groundwater that then enters into the lake.</b>	WHO	WHEN
A. Develop ordinance prohibiting the use of fertilizers in shoreland area and deliver it to the Town of Jackson with recommendation of passage as a Town Ordinance.	Peppermill Lake District	2008
	Adams LWCD	
B. Inventory and map septic systems within the Peppermill Lake .	Peppermill Lake District	2008
	Adams LWCD	
C. Explore the activities of other lake districts/assoc. who have a Sanitary Dist. regulating pre-1992 septic systems in a manner similar to Wisc Admin Code COMM 83.	Peppermill Lake District	2009
<b>Reduce nutrients entering the lake by surface water.</b>		
A. Contact property owners identified in shoreline inventory as having erosion, no riparian buffer &/or no storm water runoff management and educate and offer plan/design assistance.	Adams LWCD	ongoing
B. Pursue DNR Lake Protection Grant to assist with costs for installing shoreline protection, riparian buffers, storm water runoff, & demonstration buffer site.	Adams LWCD Peppermill Lake Dist.	ongoing

C. Develop a informational packet regarding lake laws & best management practices	Adams LWCD	2008
D. Distribute informational packet to area realtors, existing and new property owners.	Peppermill Lake Dist.	2007-2010
E. Enforce Adams County Shoreland Ordinance.	Adams P & Z	ongoing
F. Implement Agricultural Performance Standards under NR 151.	ACLWCD	ongoing
G. Using data collected by ACLWCD and updated modeling, determine nutrient budget & develop strategy for addressing it.	Adams LWCD Peppermill Lake Dist.	2008
H. Develop strategy for dealing with increased goose feces and their nutrient loading to the lake.	Adams LWCD Peppermill Lake Dist. WDNR, US FWS	2008

## **WATER QUALITY**

<b>Maintain present water quality and prevent algae blooms</b>	<b>WHO</b>	<b>WHEN</b>
A. Monitor water quality to measure success of meeting nutrient reduction goals. The lake will be sampled on at least a monthly basis during the growing season for clarity, chlorophyll a, & total phosphorus and compared to historical water quality data.	Adams LWCD Citizen Monitoring Volunteers	ongoing
B. Recruit and train more water quality monitors, then establish a regular monitoring schedule.	Adams LWCD, WDNR Peppermill Lake District	2008-2010
C. Quantify a percent of annual nutrient reduction based on water quality goals.	Adams LWCD, WDNR Peppermill Lake District	2008
D. Using updated modeling results, determine what actions to take to maintain water quality and reduce algal blooms.	Adams LWCD	2007
E. Harvest to remove biomass (nutrients) from lake.	Peppermill Lake District	ongoing
<b>Educate community and public about ways to improve water quality.</b>		
A. Obtain information from WAL and other sources and publish articles in lake district newsletters and on lake website.	Adams LWCD Peppermill Lake District	quarterly each year
B. Place informational signs regarding best management practices at public boat launch site to educate lake users	Adams LWCD, WDNR Peppermill Lake District	2008
C. Contact local schools to see if they would like to participate in lake management activities.	Peppermill Lake District	2008

<b>Practice proper land use utilizing Comprehensive Plans and Zoning.</b>		
A. Within the Peppermill Lake watershed, develop and implement smart growth plans that insure environmental protection in areas being developed.	Town of Jackson Adams P & Z	ongoing

## **WATER QUANTITY**

<b>Maintain lake levels that enhance water quality and meet the requirements of Wisconsin Statute Chapter 31.</b>	WHO	WHEN
A. Operate dam to maintain lake levels and outflows as determined by WDNR.	Dam Lessee ACLWCD	annually
<b>Maintain stable stream flow out of the Peppermill Lake.</b>		
B. Operate dams in a proactive manner so large quantities of water are not released causing downstream flooding and streambank erosion. Lake levels will be lowered in a slow consistent manner to accommodate anticipated heavy rains and/or snowmelt runoff.	Dam Lessee ACLWCD	annually
<b>Create deeper water in the lake.</b>		
A. Seek funding for a bathymetric map	Peppermill Lake, WDNR	2005-06
B. Develop a bathymetric map.	university or contractor	2006
C. Obtain 11" x 17" printings of the bathymetric map & distribute them to interested persons.	ACLWCD Peppermill Lake District	2007-2008
D. Investigate and determine the need for deepening areas of the lake. If such need exists, develop method/plan to implement. Present plan to WDNR for approval.	Peppermill Lake, WDNR Private consultant	2009

## **WATERSHED—LAND OUTSIDE SHORELAND AREA**

<b>Reduce watershed impacts.</b>	<b>WHO</b>	<b>WHEN</b>
A. Implement State Agricultural Performance Standards by inventorying watershed and documenting: runoff from livestock confinement operations entering surface waters; livestock direct access sites; uncontained livestock manure storage facilities; soil erosion sites; and producers not implementing nutrient management plans and irrigation water management plans. Offer County, State, Federal cost share assistance and plan/design assistance to landowners identified in inventory so best management practices are installed for compliance with the State Agricultural Performance Standards.	Adams LWCD, NRCS DNR, Agric. Producers private organizations	2005 to 2010

## **GENERAL ISSUES**

A. Explore value within lake variations in plan, re water quality, plant management, shorelands.	WDNR, PLD	ongoing
	ACWCD	